M1.(a) any **one** from:

- complex systems
- many different variables
- many alternative theories

1

(b) carbon dioxide allows short wavelength radiation to pass through

allow greenhouse gas(es) for carbon dioxide

1

the atmosphere to the Earth's surface

1

carbon dioxide absorbs outgoing long wavelength radiation

1

(c) general increase in temperature caused by increase in greenhouse gases

1

any **two** human activities correctly linked to a named greenhouse gas

eg

increased burning of fossil fuels causes more carbon dioxide

2

deforestation causes more carbon dioxide

more cattle production causes more methane

use of landfill causes more methane

[7]

M2. any **four** from:

*to gain **4** marks both pros and cons should be given*

Arguments for biodiesel

max **three** from:

- sustainable / renewable
- (carbon neutral) absorbs CO_2 when growing / during photosynthesis
- burning biodiesel produces low amounts particulates / carbon monoxide

  allow burning biodiesel produces little / low amount of global dimming

  ignore sulfur dioxide
- can use waste vegetable oils / fats (from food industry) **or** can use waste plant material
- can be used to conserve crude oil (instead of / mixed with petroleum diesel)
- produced by a low energy / temperature process

  accept produced by a low tech process
- biodegrades (easily)

  ignore engine effects

Arguments against biodiesel

max **three** from:

- creates food shortages

  accept price of food increases
- deforestation to plant more crops leads to loss of habitat / biodiversity **or** deforestation leads to a reduction in absorption of CO_2

  allow burning trees increases CO_2

  allow deforestation increases global warming
- burning biodiesel produces high amounts of nitrogen oxides

  allow increases acid rain
- crops takes time to grow

  allow crops can fail
- vast areas of land needed to grow crops

4

conclusion supported by the argument presented, which must give added value to the points for and against given above

1

[5]

M3. (a) (i) (thermal) decomposition

allow it breaks down

accept symbol equation or in words

allow reaction with SO_2 (to form CO_2)

1

(ii) calcium carbonate / calcium oxide / limestone / quicklime / it <u>reacts</u> with sulfur dioxide / <u>forms</u> calcium sulfate

accept it <u>neutralises</u> sulfur dioxide / <u>neutralisation</u>

ignore references to sulfur

do not accept 'calcium reacts with...'

1

(b) by incomplete / partial combustion (of the fuel)

1

insufficient oxygen / *air* (to burn fuel)

*accept insufficient oxygen / air to burn fuel completely for **2** marks*

if no other marks awarded

*accept $C + CO_2 \rightarrow 2CO$ **or***

*$2C + O_2 \rightarrow 2CO$ **or** in words for **1** mark*

1

(c) (i) any **two** from:

- (CO_2) from the atmosphere
- (CO_2) taken in millions of years ago **or** early (atmosphere)

  allow thousands / billions

  allow rocks formed millions of years ago
- (CO_2) was used to form the shells / skeletons of marine organisms / fossil fuels

  accept sedimentary rocks

  allow used to form correct named fossil fuel

  ignore limestone

2

(ii) any **one** from:

- (increases / enhances) global warming
  allow greenhouse gas / effect
  *do **not** accept ozone layer / acid rain / global dimming*
  ignore consequences of global warming

- is <u>additional</u> carbon dioxide **or** not able to be absorbed by oceans / seas **or** used by (green) plants

- acidification of sea water

1

[7]

M4. (a) (i) acid rain

accept consequences of acid rain

allow asthma / bronchitis

ignore toxic gas

1

(ii) global dimming

accept dimming alone

1

(b) (i) **sustainable:**

maximum **two** from:

- crops (that produce oil) can be grown in most places owtte
- renewable
- use less fossil fuels / diesel
- use (refined) waste oils

low pollution:

maximum **two** from:

ignore references to CO_2 here

- most emissions are lower **or** any two named emissions from CO / SO_2 / PM_{10} are lower
- much / lot less SO_2 emissions (than the others) owtte
- accept spillages / waste is biodegradable
- less new CO_2 **or** (more) carbon neutral

3

(ii) plants / photosynthesis use carbon (dioxide) from the air*

1

it / biodiesel releases carbon (dioxide) from plants / crops / photosynthesis*

*(*) allow **1** mark for biodiesel is (more) carbon neutral*

1

(fossil) diesel releases ‘locked up’ / new carbon (dioxide) / doesn’t absorb CO_2 / absorbed it millions of years ago

1

[8]

M5. (a) any **two** environmental problems with linked explanations

- global warming (1)
  accept effects of global warming

  caused by (formation of) carbon dioxide / greenhouse gas (1)
  ignore greenhouse effect

- acid rain (1)
  accept effects of acid rain
  ignore respiratory problems

  caused by (formation of) sulfur dioxide (1)
  accept sulfur oxide
  ignore sulfuric acid

- global dimming (1)
  ignore respiratory problems

  caused by (formation of) particles / particulates / fires / smoke / carbon / pm 10 (1)

- scarring of landscape (1)

  caused by mining / quarrying of coal (1)
  ignore ozone layer

max 4

(b) any **three** from:

- replant the trees / renewable / sustainable
  ignore reusable

- carbon dioxide is used by the trees / photosynthesis
  accept trees absorb carbon dioxide as they grow
  *do **not** allow respiration*

- it's a (continuous carbon) cycle
  accept 'carbon dioxide goes back into the air'
  accept trees use CO_2 which is released when trees are burnt

- no 'new' carbon (dioxide) is produced **or** no locked up carbon (dioxide) is released
  accept no carbon (dioxide) from fossil fuels is produced

3

[7]

M6. (a) **Quality of written communication**

for any two ideas sensibly stated

1

any **three** from:

- plants take in (CO_2)

  accept photosynthesis uses (CO_2)

- converted to glucose / starch / carbohydrates

  ignore carbon compounds by itself

- CO_2 locked up in fossil fuels

  accept coal / oil / <u>natural</u> gas / methane for fossil fuels

- CO_2 reacts with / dissolves (sea)water

  accept ocean removes CO_2

- producing hydrogencarbonates

  accept carbonic acid

- producing carbonates

  accept named carbonates

- marine animals use carbonates to make shells

  *do **not** accept bones*

- forms sedimentary rocks

  accept limestone / chalk
  accept marble
  *do **not** accept sediments alone*

3

(b) any **two** from:

- burning of fossil fuels **or** cars / industry / air travel / power stations

  ignore increase in population
  ignore more use of electricity

- natural processes cannot absorb all the extra CO_2

- deforestation

  accept less photosynthesis

ignore volcanic activity
accept burn trees

2

[6]

M7. (a) (i) burning / breathing / respiration / fuels / food

for 1 mark each

2

(ii) 1. rock is heated / subducted (owtte) / close to magma / melted
1. rock is decomposed / carbon dioxide released through volcanoes

for 1 mark each

2

(b) carbon dioxide reacts / dissolves in sea-water / dissolves in rain water
insoluble carbonates / calcium carbonate are / is formed carbon dioxide turned into shells / coral / limestone / chalk / sediments also soluble hydrogencarbonates (calcium / magnesium) are formed photosynthesis by plants

any three for 1 mark each

3

(c) (i) sea unable to absorb all the extra carbon dioxide being produced
more trees being cut down / deforestation increased burning of fuels / more cars / more industry (*not* more people)

any one for 1 mark

1

(ii) global warming / greenhouse effect or effects such as melting ice caps / rising sea levels / climatic change / more deserts
(*not* changes to ozone layer)

for one mark

1

[9]

M8. (a) any **two** 1 mark each

burning / combustion

fossil fuels **or** (locked up) carbon
accept fuel / named fuel

oxygen used

2

(b) any **three** from

produces (calcium) carbonate

which is insoluble

produces (calcium) hydrogencarbonate

which is soluble

photosynthesis

releases oxygen

3

[5]